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TN

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. |
|-----------------|-------------|----------------------|---------------------|
| 09/509,472 | 04/21/00 | MITSUI | M 105875 |

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IM22/0822

EXAMINER

CLARKE, Y

| ART UNIT | PAPER NUMBER |
|----------|--------------|
| 1752 | 10 |

DATE MAILED: 08/22/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trad marks

Office Action Summary

Application No.

09/509,472

Applicant(s)

MITSUI ET AL.

Examiner

Yvette M Clarke

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 May 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 May 2000 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on 19 May 2000 is: a) ☒ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7-8. 6) ☐ Other:

DETAILED ACTION

This is written in reference to application number 09509472 filed on May 19, 2000, which is a 371 of PCT/JP99/04124, filed on July 30, 1999.

Response to Amendment

1. The preliminary amendment filed on May 19, 2000 has been entered and fully considered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 6 is rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure, which is not enabling. The definition of the term "at%" is critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). It is unclear to the examiner whether the term "at% " refers to atomic or atmospheric percentage. The examiner has failed to find a definition or explanation of this term in he^t applicant's disclosure.[^]

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

5. Claims 1-26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claims as written contains the phrases "light-

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shielding function", "opaque function" and "non-transmitting function" in parenthesis. It is unclear to the examiner what these terms represent. The examiner has interpreted the phrases to be examples of the claimed "shading function", however the claims as written are unclear as to whether these functions are required or if they are merely suggested examples. If the applicant wishes for the said shading function to be selected from the said group, the applicant should use proper Markush language in the claims. Acceptable Markush language recites members as being "selected from the group consisting of A, B, and C."

6. Claim 6 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The examiner is unclear whether the term "at%" refers to atomic or atmospheric percentage.

7. Claim 9 recites the limitation "the same metal material" in line 3 of the said claims. There is insufficient antecedent basis for this limitation in the claim. Claim 1 from which claim 9 depends does not require a metal material to be used in the claimed thin film.

8. Claim 10 recites the limitation "in the nitride film" in line 5-6 of the said claim. There is insufficient antecedent basis for this limitation in the claim. Claim 1 from which claim 10 depends does not require a nitride film to be present.

9. Claim 13 recites the limitation "the nitride film" in line 5 of the said claim. There is insufficient antecedent basis for this limitation in the claim. Claim 1 from which claim 13 depends does not require the presence of a nitride film.

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10. Claim 21 recites the limitation "and the same metal contained in the thin film" in line 3-4 of the said claim. There is insufficient antecedent basis for this limitation in the claim. Claim 14 on which claim 21 depends, does not require the claimed thin film to comprise a metal.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. Claims 1-3, 6-8, 12-20, 22 and 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Babich (US 5830332A). Babich teaches a method of reactive sputtering for depositing an amorphous hydrogenated carbon film from argon/hydrocarbon/hydrogen/oxygen plasma, preferably an Ar/acetylene-helium/hydrogen/oxygen plasma. Such films are optically transparent in the visible range and partially absorbing in the UV and DUV range (abstract). The said sputtering process is carried out from a graphite target in Ar/acetylene-helium/hydrogen/oxygen plasma in which the acetylene is heavily diluted with He as the carrier gas (c. 3, l. 6-9). The reactive hydrocarbon gas helps to make the film properties similar to plasma enhanced chemical vapor deposition (PECVD), such as to achieve a high index of refraction. The hydrogen and oxygen help to increase film transmission. The Ar based sputtering process alleviates the particulate contamination issue associated with a

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purely PECVD process (c. 2, l. 46-54). Babich teaches that quartz substrates coated with the amorphous carbon film are extremely useful as mask blanks for fabrication into attenuated phase shift masks to be used at UV and DUV wavelengths (c. 4, l. 13-17). Most preferably, the substrate is a quartz or glass plate used in the production of photolithographic masks used for fabricating semiconductor devices (c. 5, l. 51-54). The power density applied to the sputter target is from $0.8\text{--}19.4\text{ W/cm}^2$. It is the examiner's position that if one of ordinary skill used a standard 12 in^2 plate and a power density of 19.4 W/cm^2 , it would give you a power of 1502 W which meets the limitations of claim 16. The amorphous carbon film is deposited on the substrate at a rate of $20\text{ to }400\text{ Å/min}$ ($.03\text{--}.67\text{ nm/s}$). It is the examiner's position that between $300\text{--}400\text{ Å/min}$ the limitations of 15 are met. Changing the resultant film thickness and/or the hydrogen content can change the transmission of the said film. The preferred transmissivities of the amorphous carbon film prepared by the taught invention is in the range of $5\text{--}10\%$ at a wavelength of $365, 248\text{ and }193\text{ nm}$. It is the examiner's position that at $5\text{--}10\%$ transmission would mean a $90\text{--}95\%$ non-transmitting function, thereby meeting the claim limitation of having a shading function. One of ordinary skill would expect that a sputtering process as taught by the given invention would produce a thin film, which has a crystal grain size within the range of $1\text{--}7\text{ nm}$.

Example 4 exemplifies the use of a quartz plate coated with a photoresist, which is exposed to laser writing, developed and then etched (RIE) in oxygen plasma. An amorphous carbon film of the taught invention is then sputtered onto the formed substrate. A photoresist is deposited on the film and patterned and an oxygen RIE is

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used to etch the amorphous carbon film. The photoresist is removed leaving a phase shift mask (c. 10, l. 54-c. 11, l. 12). It is the examiner's position that the exemplified process of example 4 meets the claim limitation of claims 13 and 25-26 as set forth by the applicant.

Claim 1 of the taught invention establishes that the flow rate of argon is from 1-100 sccm; hydrogen from 1-10 sccm; oxygen no more than 10 sccm and the hydrocarbon/helium mixture from 5-100 sccm wherein the mixture contains 1-50% hydrocarbon and 50-99% helium. Therefore, it would have been obvious to one of ordinary skill to have a helium content of 30-90 vol% in order to have a reactive hydrocarbon gas mixture that achieves the desired index of refraction. It would also have been obvious to determine the amount of helium required to achieve the desired index of refraction prior to performed the taught patterning process. It would have been obvious to one of ordinary skill in the art in light of the teachings of Babich to develop a mask comprising an amorphous carbon film which is sputter deposited onto a quartz substrate in a helium atmosphere which has a non-transmitting function of 90-95% in order to obtain a mask capable of improving lithographic ground rules and the performance of circuits by increasing exposure depth-of-focus of the optical tool (c. 1, l. 19-31).

13. Claims 1-8, 10-20 and 22-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyashita (US 5738959A). Miyashita teaches a method for producing the halftone phase shift photomask blank comprising at least one film layer composed mainly of chromium compound containing at least fluorine atoms. The said

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film is superior in the transmittance in the short wavelength region compared to conventional films (c. 3, l. 55-67). The chromium containing film is sputtered onto a substrate in an atmosphere, which contains only a sputter gas such as argon, neon, helium or nitrogen or a combination of a sputter gas and a fluorine source gas. If necessary, the atmosphere may be mixed with an oxygen, nitrogen or carbon source gas (c. 4, l. 49-65). The method of producing a chromium compound containing fluorine atoms according to the taught invention is a thin-film forming method in which chromium is evaporated in a vacuum chamber and deposited on a transparent substrate for a photomask (c. 5, l. 42-46). When the said chromium film is used as a single layer, it can be patterned by approximately the same method as that used for conventional photomask (c. 6, l. 40-55). Miyashita teaches that an additional layer of a material selected from the group consisting of chromium oxide, chromium oxide nitride and chromium oxide carbide nitride can be coated onto the said chromium layer as a light-blocking layer to adjust the transmittance within the range in which the phase inversion function is not impaired (c. 4, l. 26-31; c. 11, l. 24-29). It is the examiner's position that the said additional layer constitutes an antireflective film as claimed in present claim 4. The film of the taught invention can be used as halftone phase shift film if the transmittance for exposure light falls within the range of from 1-50%. It is the examiner position that if 1-50% of the light is transmitted, then 50-99% of the light is non-transmitted, thereby meeting the claims limitations of having a shading function. Example 2 discloses a process wherein the formed blank is provided with a resist pattern of an organic material formed by conventional photolithography to obtain a

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halftone phase shift photomask. The formed photomask has a transmittance of 5% and was practical in all requirements such as dimensional accuracy of the etched portions, film thickness and transmittance distribution (c. 14, l. 40-64). It would have been obvious to one of ordinary skill in the art based on the teachings of Miyashita to develop a mask comprising a chromium thin film which is sputtered in a atmosphere comprising a combination of helium and fluorine source mixed with small amounts of oxygen, nitrogen and carbon dioxide gas. It would have been obvious to one of ordinary skill in the art, light of the teachings of Miyashita to adjust the parameters of pressure, sputter power, and atmosphere gas composition prior to sputtering in order to alter the refractive index and extinction coefficient of the resulting film (c. 4, l. 60-65).

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Sakurai et al. (US 6265696 B1) which teaches a mask blank in which a thin film containing metal of chrome or the like is formed on a transparent substrate such as quartz or the like [filing date of 8/11/99-not citable as prior art].
- Isao et al. (US 6228541 B1) which teaches a uniform thin phase shifting mask formed by depositing a thin film on a substrate by a reactive sputtering technique.
- Mitsui et al. (US 6087047 A) which teaches a half-tone phase shift mask blank in which a semi-transparent film is formed on a transparent substrate.
- Mitsui et al. (US 5942356 A) which teaches a half tone phase shift mask formed with a thin film light translucent portion made of essentially nitrogen, metal and silicon.
- Okubo et al. (US 5935735 A) which teaches a zirconium compound target sputtered on a quartz glass substrate thereby forming a blank for halftone phase shift mask.
- Yokoyama et al. (US 5811208 A) which teaches a phase shift mask comprising a transparent substrate a single layer or a plurality of layers of a halftone phase shift film.


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- Hashimoto et al. (US 5538816 A) which teaches a halftone phase shift photomask comprising a transparent substrate, a region which is transparent to exposure light and a region which is semitransparent to exposure light.
- Sakamoto (US 4958083 A), which teaches an inspecting apparatus capable of accurately inspecting an object.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yvette M Clarke whose telephone number is 703-305-0589. The examiner can normally be reached on Monday-Thursday 7-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Janet Baxter can be reached on 703-308-2303. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-3599 for regular communications and 703-305-3599 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

ymc 
August 20, 2001


JANET BAXTER
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TECHNOLOGY CENTER 1700